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⑤④ **Closure.**

⑤⑦ A closure for sealing a circular opening in a pipe or vessel (2) is provided comprising a closure body (1), a plurality of arcuate locking members (5) mounted on the closure body and movable between released and engaged position. An operating member (6) which may be moved angularly about an axis offset from the centre of the closure body (1) by manipulation by an operator is connected to a drive pinion (7) angularly movable so as to be therewith. The drive pinion (7) includes an eccentric drive pin (8) journaled at one end of one locking member (5). A toothed wheel (10) is angularly movable about the central axis of the closure and meshes with the drive pinion (7) and with a plurality of slave pinions (14). The slave pinions (14) are mounted one at the other end of said one locking member (5) and one at each of the ends of the other locking members (5). Each slave pinion (14) also includes an eccentric drive pin (13) journaled on the respective locking member (5). In operation movement of the operating member (6) causes movement of the drive and slave pinions (7,14) such that the drive pins (8,13) move the locking members (5) to either their released or engaged position.

Suitably the closure further includes a safety pressure release means (16) which interlocks with the operating member (6) and has to be released

before the operating member can be manipulated to open the closure. A further safety feature against residual pressure consists of a safety latch (18) which limits the opening movement of the closure.

## CLOSURE

This invention relates to a closure for sealing against internal pressure within a pipe or vessel and to a pipe or vessel including such a closure.

There are many instances where a closure is required to seal against an internal pressure such that a conventional latching mechanism will not suffice. Yet such a closure needs to provide a quick, safe and easy means of access into the vessel or pipeline when the internal pressure has been vented.

According to the present invention a closure for sealing an opening in a pipe or vessel comprises a closure body, a plurality of locking members mounted on the closure body and movable between a released position in which the closure may be opened and an engaged position in which the locking members are arranged for engaging about the mouth of the opening to be sealed, and means for effecting the movement of the locking members, the said means including an operating member which may be manipulated by the operator, angularly movable drive means connected to the operating member and angularly movable by the operating member, angularly movable slave means co-operable with the drive means so as to be moved on movement of the drive means, and a drive connection between at least the slave means and each of the locking members, the drive connections being eccentrically positioned with respect to the axes of angular movement of the respective slave means so as to move the locking members between the released and engaged position on angular movement thereof.

Preferably the closure is circular in plan and there are at least three arcuate locking members. The angularly movable drive means preferably includes a drive pinion mounted off-centre which meshes with a larger toothed wheel mounted for rotation about the centre of the closure. The slave means may comprise slave pinions which mesh with the toothed wheel. In the preferred arrangement each locking member has two slave pinions except one, which includes a slave pinion and the drive pinion. The drive connection may be an eccentric drive pin mounted on the slave and drive pinion and journaled at respective ends of the locking members.

The operating member may be an operating handle including a safety pressure release means which has to be released before the handle may be operated thereby providing an audible or visible warning of residual pressure within the pipe or vessel. The closure may also include a safety latch which prevents the closure being swung open by residual pressure in the event that an operator

ignores the warning of the safety pressure release means.

In accordance with a preferred aspect of the present invention there is provided a closure for sealing a circular opening in a pipe or vessel comprising a closure body, a plurality of arcuate locking members mounted on the closure body and movable between released and engaged positions, an operating member which may be moved angularly about an axis offset from the centre of the closure body by manipulation by an operator, a drive pinion angularly movable about said axis by operation of the operating member and including an eccentric drive pin journaled at one end of one locking member, a toothed wheel angularly movable about the central axis and meshing with the drive pinion, and a plurality of slave pinions, one at the other end of said one locking member and one at each of the ends of the other locking members, meshing with the toothed wheel and each including an eccentric drive pin journaled on the respective locking member whereby movement of the operating member causes movement of the drive and slave pinions such that the drive pins move the locking members to either their released or engaged position.

The invention also includes a pipe or vessel including a closure as aforesaid.

The invention will now be described by reference to the accompanying drawings in which:

Figure 1 shows a sectional side elevation of the preferred embodiment of closure in the closed or operating position;

Figure 2 is a side elevation on a smaller scale showing the closure of Figure 1 in open position;

Figures 3 and 4 are diagrammatic front elevations showing the closure of Figure 1 in the locked and unlocked positions respectively;

Figures 5 and 6 are a front elevation of the closure incorporating a first safety means in the engaged and unengaged positions; and

Figures 7 and 8 illustrate a second safety means in the engaged and unengaged positions.

In the drawings a closure 1 is provided and arranged to close an opening in a neck ring 2. The neck ring 2 can be welded to a vessel or pipeline or can be integral with the vessel as in the case of a cast or forged vessel. The closure 1 is attached to the neck ring 2 by way of a hinged weatherproof cover 4 which protects the operating mechanism and allows the closure to be hinged open and closed. Once swung to the closed position, the closure 1 retains internal pressure and is held against pressure seal 3 by means of locking seg-

ments 5 which are movable into a grooved recess 35 in the neck ring 2. In the embodiment of this invention illustrated there are three such locking segments 5 which fit into the grooved recess 35 and preferably, in accordance with the invention there are three or more such segments 5.

The locking segments 5 may be moved into engagement with, or released from, the groove 35 by means of an operating handle 6 attached to one end of a drive pinion 7. The drive pinion 7 passes through a bearing in the weatherproof cover 4 and the end of the pinion remote from the handle 6 is formed into an eccentric circular drive pin 8 at one end of the locking segments 5. The drive pinion 7 is positioned so that its teeth engage with those of a rotatable toothed wheel 10 which is rotatably mounted on a centrally located bearing 11. Engaged within a hole or bearing 12 at the other end of the locking segment 5 with the drive pinion 7 is a similar eccentric circular drive pin 13 which is part of a slave pinion 14 which is also positioned so that its teeth engage with those of the toothed wheel 10. The slave pinion 14 is rotatably mounted on a stub shaft 15 attached to the weatherproof cover 4. The remaining locking segments 5 are each fitted with one slave pinion 14 at each end which are similarly rotatably mounted and are positioned to mesh with the toothed wheel 10. Thus rotation of the operating handle 6 also rotates the drive pinion 7 which in turn drives the toothed wheel 10 and hence the slave pinions 14. Alternatively the toothed wheel 10 could be a drive wheel with all the pinions, including pinion 7 being slave pinions.

It will be seen from Figures 3 and 4 that angular rotation of the drive pinion 7 and slave pinions 14 moves the centres of the respective eccentric drive pins 8 and 13 towards and away from the centre of the closure. As the drive pins 8 and 13 are journaled on the locking segments 5, the locking segments 5 are driven in and out of engagement with the grooved recess 35 in the neck ring 2. Preferably the radially outer edges of the locking segments 5 are slightly tapered to facilitate their entry into the recess in the neck ring 2 and also to force the closure 1 against the pressure seal 3 so as to slightly compress it.

It is preferred in the embodiment of closure of the invention to include safety features in the design:

- (a) to prevent the operating handle 6 from opening whilst the vessel or pipeline is still pressurised;
- (b) to prevent the closure 1 from fully opening if there is residual internal pressure; and
- (c) to prevent the vessel or pipeline being repressurised unless the locking segments 5 of the closure 1 are fully engaged.

For example, Figure 5 shows the provision of a safety vent plug 16 centrally positioned on the closure which is interlocked with a depression 23 in the edge of the operating handle 6 which is in the form of a wedge-shaped plate. With this arrangement the operating handle 6 can not be moved from the closed position until the safety vent plug 16 is partially unscrewed. Once the plug 16 starts to unscrew, a bleed hole or slot 17 allows any residual gas or liquid to vent to atmosphere thereby giving audible or visible warning that the vessel has not been properly isolated and vented of internal pressure. Where a slot is provided it would suitably comprise a slot up the side of the thread of the vent plug 16. An added feature of this arrangement is that the safety vent plug 16 can only be re-tightened with the operating handle 6 in the closed position to move the depression 23 back adjacent to the plug 16 thereby ensuring that the locking segments 5 are fully engaged. The released position of the operating handle is shown in Figure 6. A similar arrangement is shown in Figure 1 where the safety vent plug 16 is slightly offset from the centre. The positioning of the vent plug is normally determined by the size of closure i.e. for smaller sizes the vent plug is positioned centrally but in larger sizes it is offset to reduce the need for a larger handle.

A further safety feature that can be incorporated is a retaining latch 18 as shown in Figures 1, 7 and 8. The retaining latch 18 provides a secondary back-up such that, if an operator ignores the audible or visible warning signal from the safety vent plug 16 it can be possible at low internal residual pressure to force the operating handle 6 to the open position. If this happens the closure 1 moves outwardly to the position shown in Figure 7 to engage the retaining latch 18. This movement is permitted by the provision of a clearance 36 provided between the latch 18 and a bracket 19, attached to the weatherproof cover 4 on the opposite side to the hinge 20, when the closure 1 is fully shut as shown in Figure 1. A lip 37 on the retaining latch 18 then engages the bracket 19 as shown in Figure 7 and prevents the closure 1 from being swung fully open. Once the closure 1 is partially opened and the internal pressure fully vented as shown in Figure 7, it is possible to slightly close the closure 1 and swing back the retaining latch 18 prior to fully opening the door. On re-closing of the closure, the retaining latch 18 automatically re-engages with the bracket 19 by virtue of the loading applied by a spring 21. Once the operating handle 6 is moved to the closed position, a depending rim 22 at its periphery prevents the retaining latch 18 from being swung out of engagement in all but the fully open position (see particularly Figures 1, 5 and 6).

## Claims

1. A closure for sealing an opening in a pipe or vessel (2) comprising a closure body (1), a plurality of locking members (5) mounted on the closure body (1) and movable between a released position in which the closure may be opened and an engaged position in which the locking members (5) are arranged for engaging about the mouth of the opening to be sealed, and means for effecting the movement of the locking members (5), the said means including an operating member (6), characterised in that the said means further includes angularly movable drive means (7) connected to the operating member (6) and angularly movable by the operating member (6), angularly movable slave means (14) co-operable with the drive means (7) so as to be moved on movement of the drive means (7), and a drive connection (8,13) between at least the slave means (14) and each of the locking members (5), the drive connections (8,13) being eccentrically positioned with respect to the axes of angular movement of the respective slave means (14) so as to move the locking members (5) between the released and engaged position on angular movement thereof.

2. A closure according to claim 1 wherein the closure body (1) is circular in plan and there are at least three arcuate locking members (5).

3. A closure according to the claim 2 wherein angularly movable drive means includes a drive pinion (7) mounted off-centre of the closure body (1) and which meshes with a larger toothed wheel (10) mounted for rotation about the centre of the closure.

4. A closure according to claim 3 wherein the slave means (14) comprise a plurality slave pinions (14) which mesh with the toothed wheel (10) so as to be co-operable with the drive pinion (7).

5. A closure according to claim 4 wherein each locking member (5) has two slave pinions (14) except one, which includes a slave pinion (14) and the drive pinion (7).

6. A closure according to claim 5 wherein the drive connection (8,13) to each locking member (5) comprises a connecting pin (8,13) eccentrically mounted on the slave and drive pinions (7,14) and journaled at respective ends of the locking members (5).

7. A closure for sealing a circular opening in a pipe or vessel (2) comprising a closure body (1) a plurality of arcuate locking members (5) mounted on the closure body (1) and movable between released and engaged positions, an operating member (6) which may be moved angularly about an axis offset from the centre of the closure body (1) by manipulation by an operator, a drive pinion (7) angularly movable about said axis by operation

of the operating member (6) and including an eccentric drive pin (8) journaled at one end of one locking member (5), a toothed wheel (10) angularly movable about an axis at the centre of the closure body (1) and meshing with the drive pinion (7), and a plurality of slave pinions (14), one at the other end of said one locking member (5) and one at each of the ends of the other locking members (5), meshing with the toothed wheel (10) and each including an eccentric drive pin (13) journaled on the respective locking member (5) whereby movement of the operating member (6) causes movement of the drive and slave pinions (7,14) such that the drive pins (8,13) move the locking members (5) to either their released or engaged position.

8. A closure according to any of the preceding claims wherein the operating member (6) is an operating handle which may be manipulated by an operator and includes a safety pressure release means (16) which has to be released before the handle may be operated thereby, in use, providing an audible or visible warning of residual pressure within the pipe or vessel.

9. A closure according to any of the preceding claims including a safety latch (18) which limits the opening movement of the closure to prevent the closure being fully swung open by residual pressure.

10. A pipe or vessel including a closure according to any one of the preceding claims

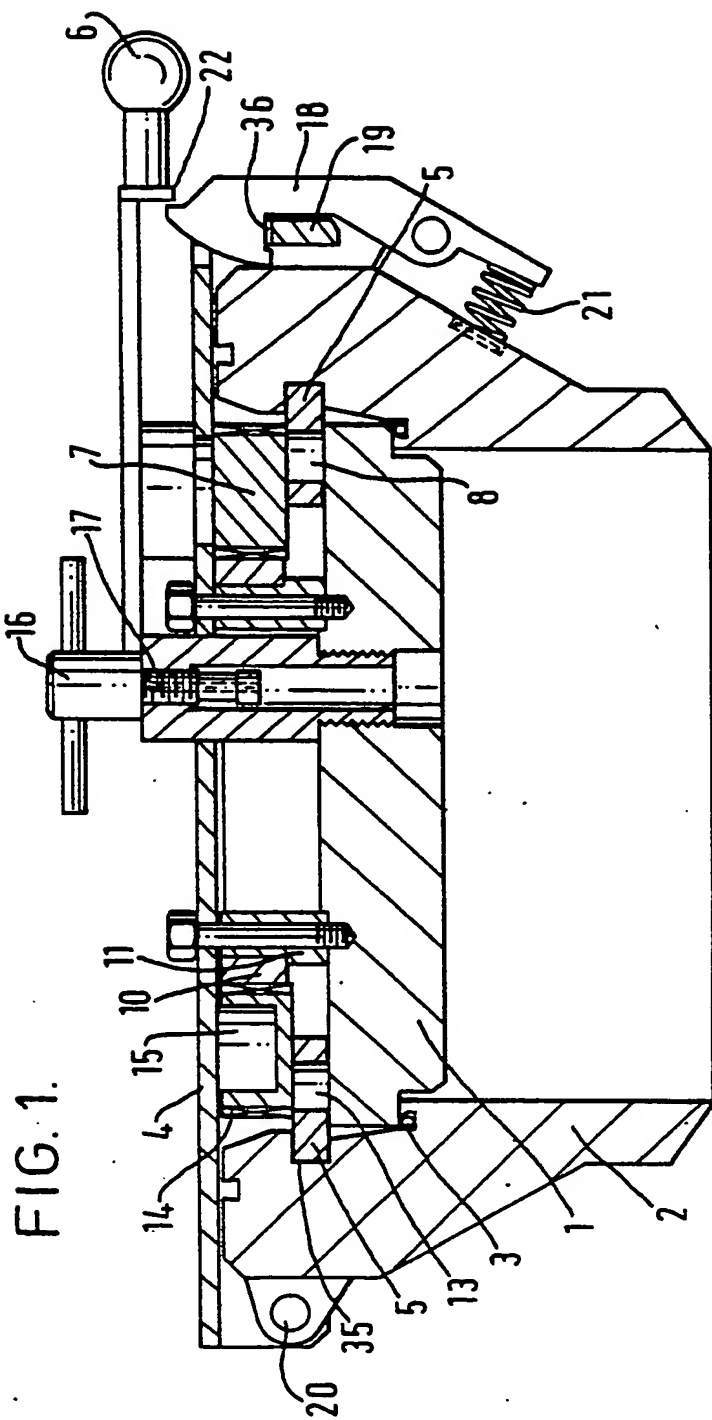
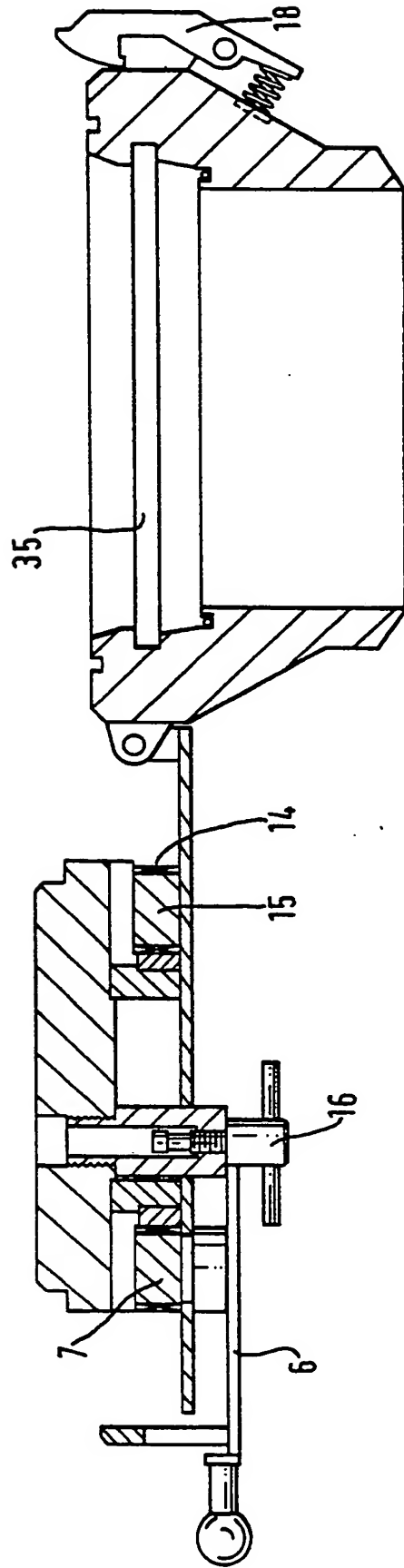


FIG. 2.



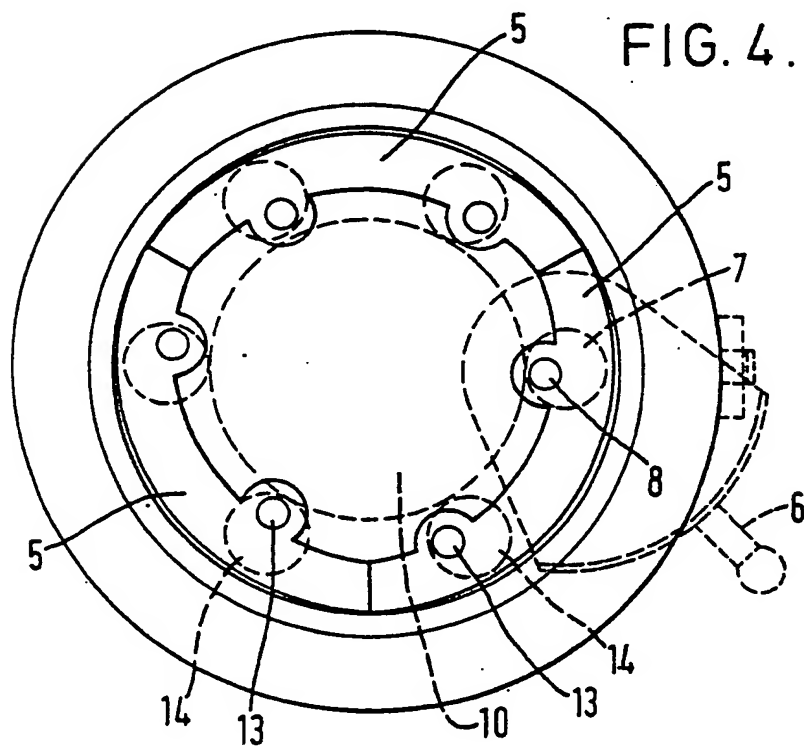
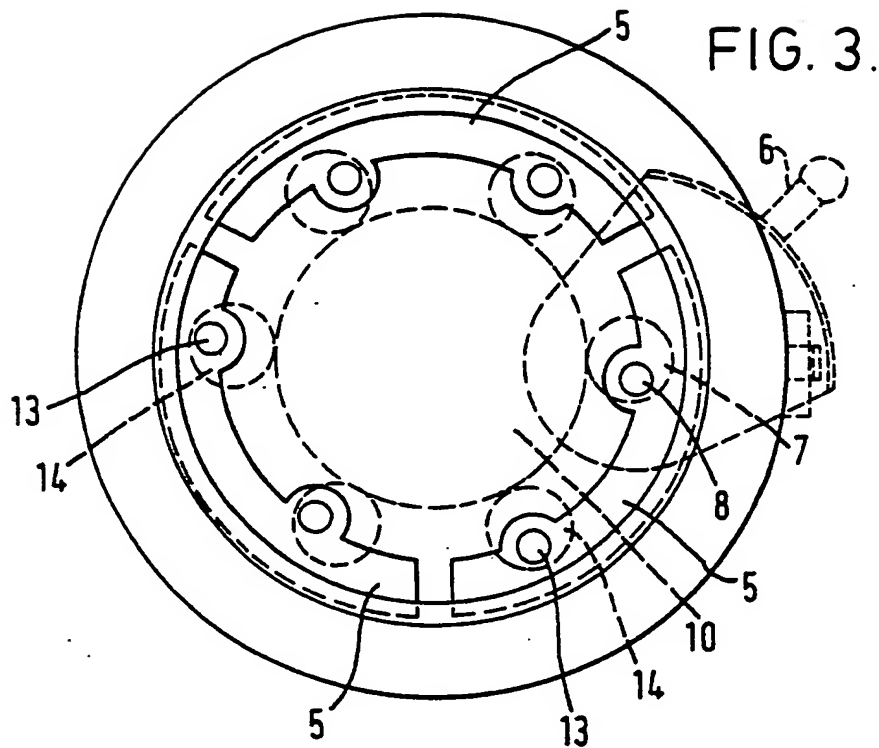


FIG. 5.

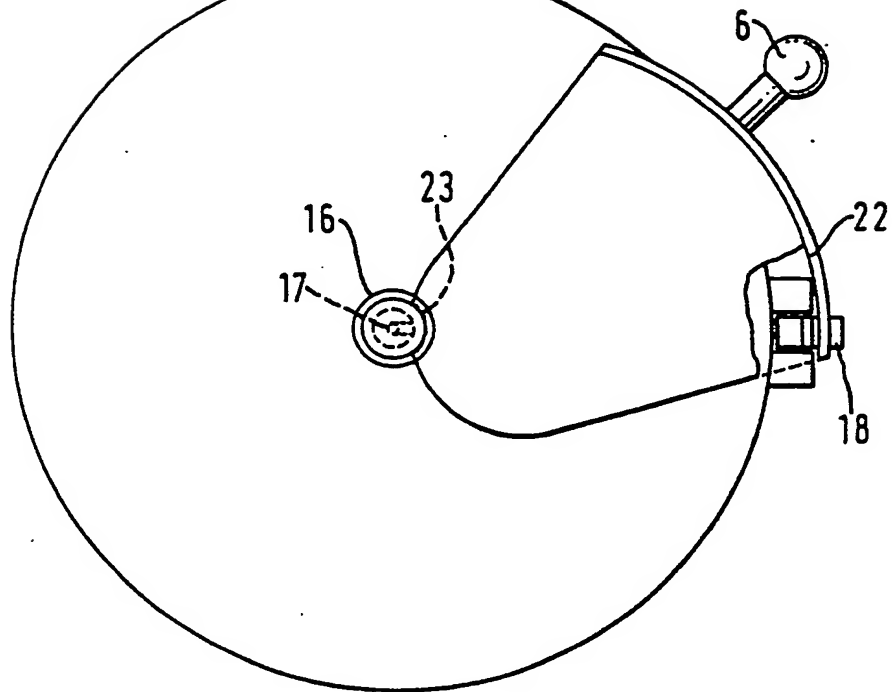
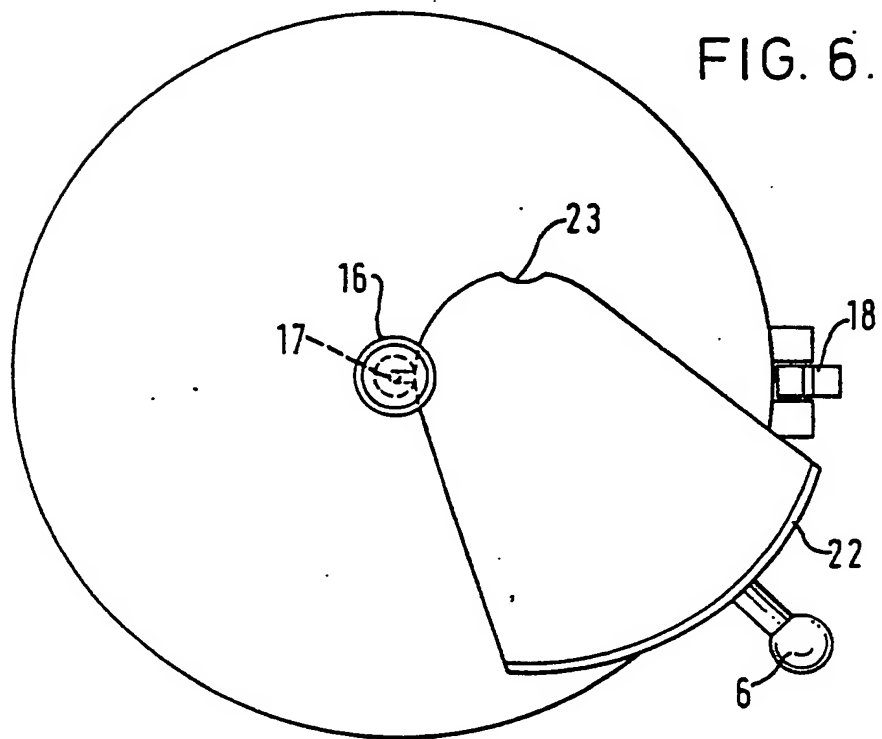
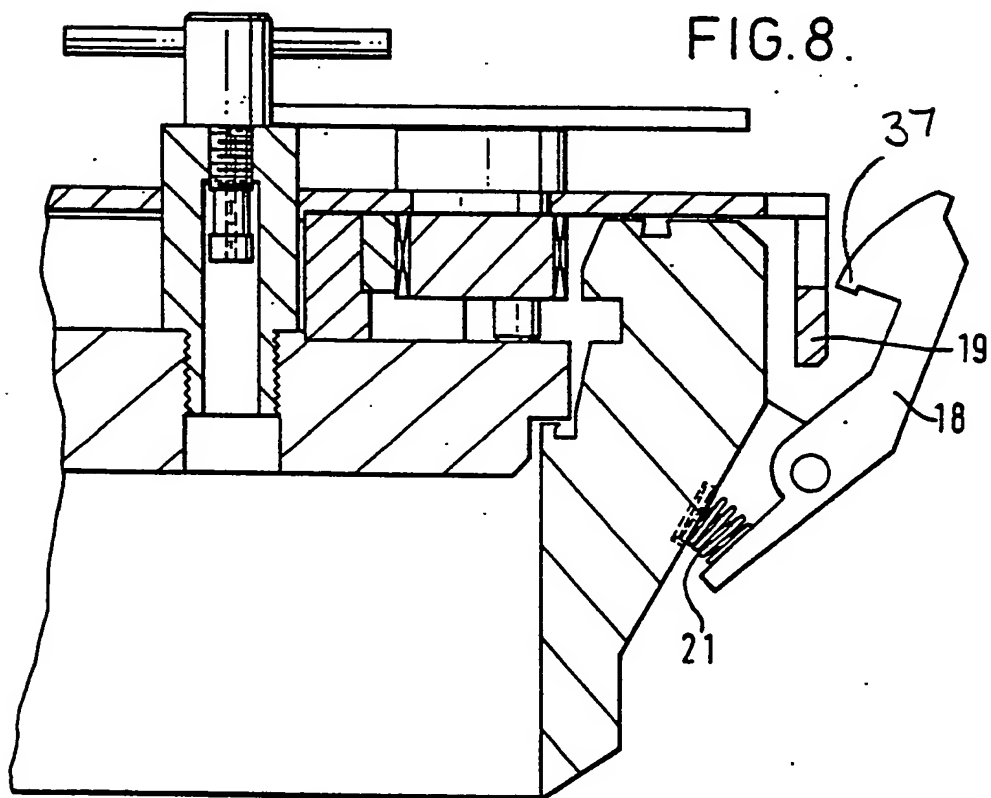
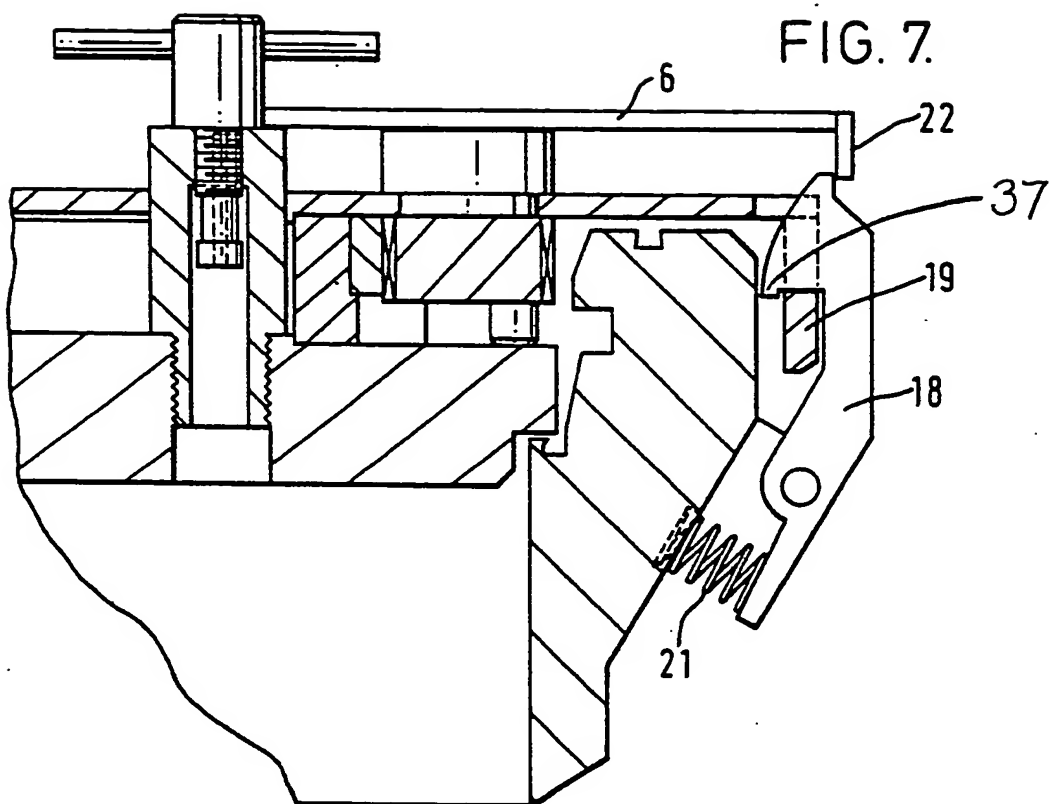


FIG. 6.





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